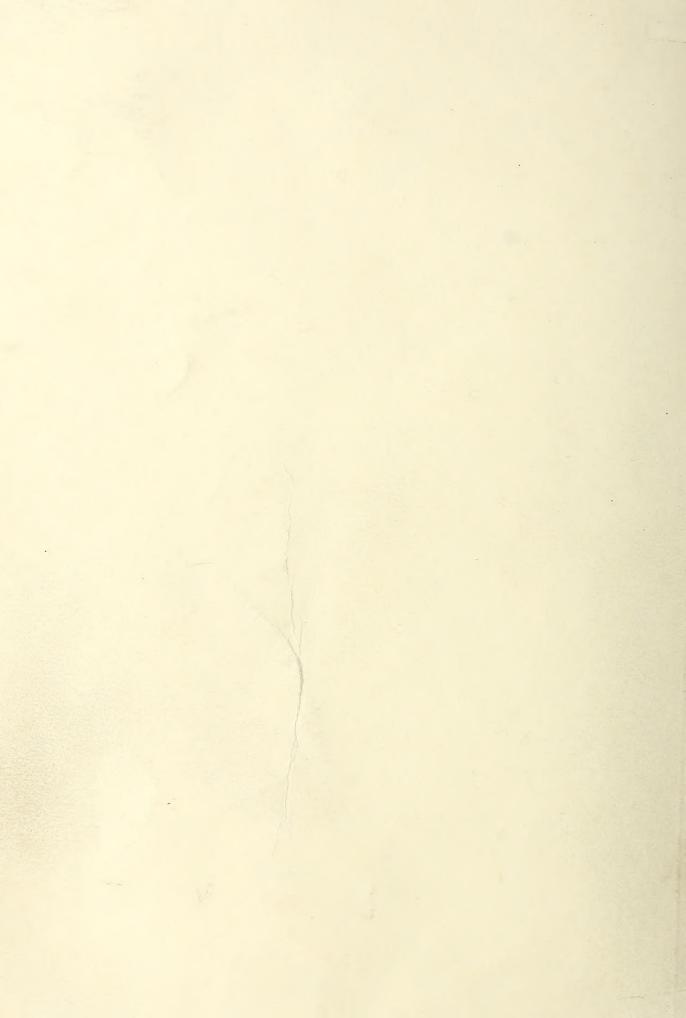
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STORAGE IN FLAXSEED MARKETING .

Abstract Bibliography of Selected References and Sources of Data //
By Donald B. Agnew, Agricultural Economist 1/

INTRODUCTION

This preliminary report presents under one cover information which heretofore was available only from widely scattered sources. It is not intended to represent a complete or balanced bibliography covering all aspects of flaxseed marketing. The references abstracted were selected because of their bearing on flaxseed storage problems and practices, or on aspects of flaxseed marketing problems that appear to be closely replaced to flaxseed storage.

Over nine-tenths of the U. S. flaxseed crop is produced in the Northern Plains States. On commercial family-operated farms in this area a greater proportion of the cropland is devoted to flaxseed than any other crop except wheat. Consequently, a considerable amount of the research on flaxseed has concerned such production problems as adapted varieties, increased yields, more uniform growth and ripening characteristics, or improved resistance to rust, pasmo, and other diseases. Not only to farmers but also to country elevator operators who assemble and ship grain to market, however, flaxseed is often of secondary importance as a source of income. Therefore, even in the principal Northern Plains

^{1/} Special Crops Section, Marketing Research Division, AMS (December 1954).

⁵⁰ Agriculture = Washington

producing region, a relatively limited amount of research has been or is being devoted to economic aspects of marketing, storing, conditioning, or processing flaxseed.

From farms to processors, flaxseed is marketed as a grain crop.

Consequently, reference is made to standard textbooks on marketing agricultural products or on agricultural prices for perspective on the grain market structure and functions, including trading in grain futures contracts at central market exchanges. Reference is made also to selected U. S. Department of Agriculture publications for more detailed information on appropriate marketing functions and problems, and for research methods used in previous studies of various aspects of farm storage and farmers' economic responses. 2/

Sources consulted included (1) the Card Catalog, U. S. Department of Agriculture Library; and (2) Bibliography of Agriculture, July 1942 to date, covering research published as far back as the mid-1930's. The directors of agricultural experiment stations in all flaxseed producing States were contacted with respect to published and current research in flaxseed storage and marketing by their staffs, including workers in agricultural economics, marketing, agronomy, and agricultural engineering.

Flaxseed Storage Problems. The search of literature and sources of data was conducted to obtain and evaluate published information and data relating to five major aspects of flaxseed storage problems. The problems include (1) the relative economic advantage to producers of

^{2/} The list of additional references, pages 16 and 17, is limited to those that appear directly useful to studies in flaxseed storage and marketing.

storing flaxseed at harvest for later sale, compared with selling at harvest time; (2) the comparative advantages and cost (including shrinkage and changes in grade) of storing flaxseed at country elevators or on farms; (3) the effect of the length and the conditions of storage on changes in grade factors and oil quality of the flaxseed occurring during storage, together with the significance of these grade and quality changes in terms of their relation to processing loss for flaxseed and refining loss for linseed oil; (4) the adequacy of available market place storage for flaxseed at country assembly points, terminals, and processing plants; and (5) the comparative cost and advantages, to industry and to potential national security needs, of carrying Government-owned stocks as flaxseed or as linseed oil.

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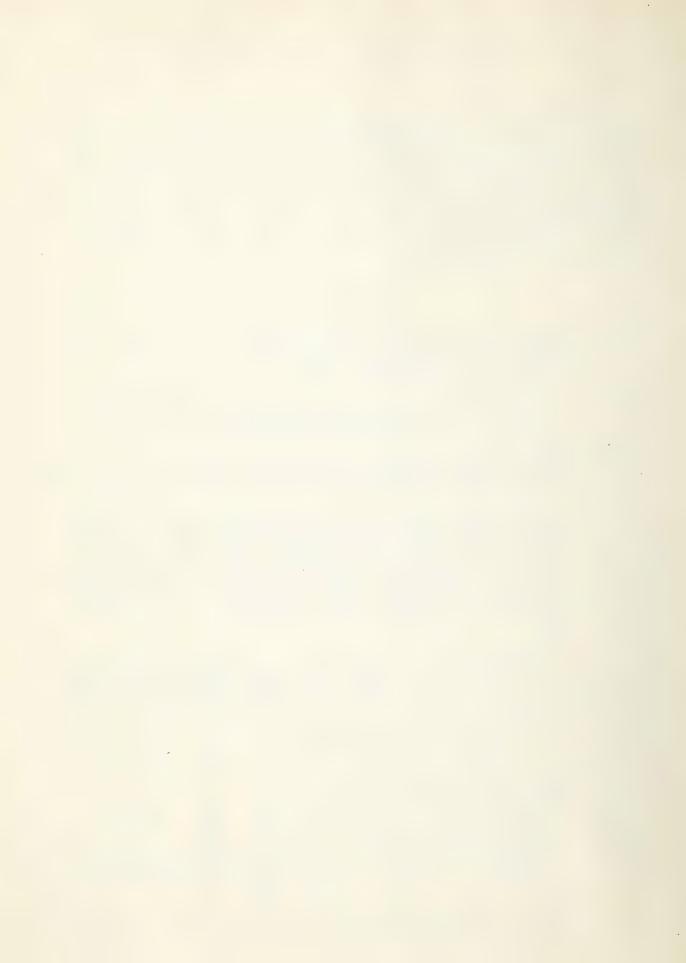
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Pederson, Mercid C. 1962, Prifficial Dryin, of Grain is Increasing, Him. Acre Drie Service. Connects Form Justanes Notes, No. 187, December 18:

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Screnson, J. W., Jr., and Davenport, M. G.
1951. Draing and Sturing Flores in Texas. Agr. Reginsewing 32(7):
3/9-142. fully.

oflax harvest in Southern Texas (27),000 neves in 1919) starte in latter April-early May, the period of highest harding and rising temperatures. Excess acisture at harvest time and until-infactory methods of storage often lead to serious deterioration. Germination and chemical properties of flauseed was not inpuised by artificial drying with air temperatures up to 275 degrees. Though 7 to 9 percent moisture flauseed was stored in sacks without out loss in germination, 8 percent moisture was found too high for bulk storage. Flauseed was stored in both bulk and sacks without serious increase in acid number, though seed temperatures above 86 to 88 degrees over prolonged period caused reduction in germination."

Grade and Inspection

Cox, Rex W., and Brookins, W. W.
1943. Dockage in Flaxseed. Mirm. Agr. Expt. Sta. Bul. 371, 12 pp.

"Purpose is to present the provalence and economic significance of the dockage problem in various flanseed-producing areas of Minneseta and to show how flan producers' financial returns may be increased through improved weed control.

"During the crop season 1941-1942, 9797 carloads of flaxeed received at Minneapolis from Minneapola, the Dakotes, and Montana (84 percent of the total from Minnesota) averaged 11.3 percent dockage, ranging from 3 to 37 percent. One-third of the care had less than 10 percent, one-half 10 percent to 15 percent, and one-fifth 15 percent or more, of dockage.

"During the August-November 1942 period, 4691 care of flax received at Minnespolis from Hinnesota show a significant reduction in the amount of dockage although weed infestations were much more serious in flax in the latter year . . . this may be due to cleaning of high dockage flax before shipment. There is no evidence to indicate any material improvement in dockage from 1921-24 seasons to 1930-31, 1934, or 1941 seasons. Crop reporting districts, and shipping points within a county also vary significantly.

"Becords from 276 farmers in 15 flarseed producing counties show 15 percent with deckage from 20 to 70 percent. The 25 percent of farms with less than 10 percent deckage compares closely with the proportion of all shipping points in the state in this class; the high-deckage group of farms is correspondingly much higher, indicating that high-deckage flax is cleaned at country shipping points.

"Removal of all weed seeds and foreign material generally results in a shrinkage of at least 15 percent to 20 percent from the original amount of flax, both sound and broken flaxseeds being



respect in the cleaning, was Dakota indicate that the less outwight any west control benefit

Dillman, A. C., and Black, R. H.

Tion. Il pp. Sept. (Processed.)

win tests in September 1928 the higher moisture conseed from the combine than from the standing flax the threshed seed took up moisture from the weed sometime samples. The average moisture () the read mois (orderly) or factable moisture () thus) in the dockage was 15.7 percent.

*Ifter fluxneed containing dockage is placed in storage, from ference of moisture from the weed seeds to the fluxneed continues and the fluxneed continues according to the fluxneed continues according to the fluxneed continues from 1 to 3 percent more moisture than the fluxneed dockage contains from 1 to 3 percent more moisture than the fluxneed and

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Ther H. H. Seed Treatment of Tax. H. Der Fur Fore Ser. Burely for 5(5):23-25. May.

Three second varieties and yellow decoded varieties are units project to cracking and one true during threshing that the court broads are fallewing Cartain broadsant of the contained machined injured second to the oping of 1942, 75 low of North Dukota flaracods county and generations from lots send on two produces for parity and generation tests, second 50 to 52 per ment whole seed, here then 3 percent broken ben 20 parties in the percent broken ben 2

Tentionh, J. E., and Drom. A. M.
1982. Proliminary furedispations on Mochanical Injury of The Land.
Proceedings of 12078 130730. August.

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Ryan, John A.

1951(?) Production and Marketing of Flax in Texas. Tex. Red. Series

No. 1, U. of Texas, Bur. Bus. Admin., Austin, T. pp.

"Storage is the main problem in Texas. The high relative hunidity and susceptibility of flausced to moisture make control (of data storation) difficult. When flausced is stored in a hot, hunid climate for more than 3 months, some deterioration is probable. Storage periods greater than 3 months also cause the fatty asids to increase with reduction in quality of the oil."

1949. U. S. Dept. Agr. Hendbook of Official Grain Standards of the United States. Production and Narhoting Adm.

"Flanced shall be any grain which, before the removal of doolings; consists of 50 percent or more of flanced and not more than 10 percent of other grains for which standards have been established

Grade requirements summarized:

Grade number	40 - 40 - AND THE PROPERTY AND ADDRESS OF THE PERSON NAMED IN COLUMN TO ADDRES	hum test at per bu-	POTAGE	Mariama A flerseed	\$ 110	and the same of th
1 2 Sample grade*	: 47	pounds pounds	20	percent	77	percent percent

* Sample grade shall include flarseed which does not come within the requirements of either grade No. 1 or No. 2, or which contains fire-damaged flarseed or more than 11 percent moisture; or which is musty, or sour, or heating, or hot; or has any commercially the jectionable foreign oder; or is otherwise of eletinotly her quality:

Plochage shall include all matter other than flammed which is cantained in the lot of grain as a whole; also undeveloped shriveled and small pieces of flammed removed with the declare and which cannot be recovered by properly rescreening and reclaming. The quantity of dockage shall be calculated in terms of percentage based on the total weight of the flammed including the dockage; and shall be stated in terms of a whole percent, fractions discregarded. The word 'Dockage' together with the percentage there of shall be added to the grade designation.



"Damage flanseed shall be seeds and pieces of flant of which the heat damaged, sprouted, frosted, badly ground damaged, bailly weather damaged, or otherwise meterially damaged."

Prices

Benton, Alva H.

1933. Hedging Grain by Fermers' Elevators - Gains and Losses. N. Dak.
Agr. Expt. Sta. Bul. 272. 42 pp.

Contains studies on hedging of flax by individual elevators for h seasons commencing 1925-26, showing volume of flax handled, volume of futures and gross trading profits.

Peterson, Weber H.

19h2. Wheat and Flar Prices Received by Farners in North Central and Rorth Eastern South Dakota. 1890-19hJ. South Dak. Agr. Expt. Sta. Cir. 37, 16 pp.

"Purpose is threefold: To supply price data by areas, to analyze briefly their effects on South Dakota farmers, to aid the furner in deciding whether to store or sell cash grain crops at harvest time. In the case of neither wheat nor flax does the seasonal price appear large enough to justify increased storage operations by farmers if this involves building additional storage capacity. There was no appreciable difference in earning capacity of wheat and flax in those areas which produce both."

Ratcliffe, Harry E.

1933. Flarseed-Factors Influencing Prices in North Dakota. N. Dak.
Agr. Expt. Sta. Bul. 200, 37 pp.

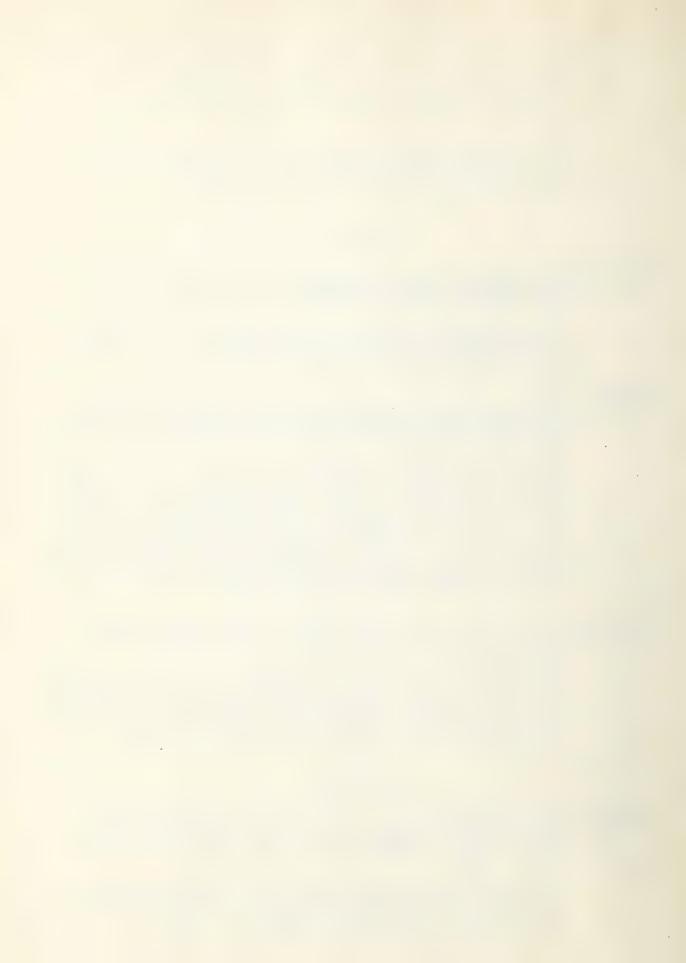
"Based on technical analysis for 10-year period beginning September 1922, most important factors influencing or associated with flam prices were demand for linsood oil, flamsed supplies in Argentina and, during fall, probable size of new crop in Argentina."

Quality

Dillwan, A. C., and Hopper, T. H.

1943. Effect of Climate on Yield and Cil Content of Flaxseed and un loding Number of Lineard Cil. U. S. Dept. Agr. Tron. Bal. Cil., C. pp. April.

"Well known that growth and physiological development of flamestaincluding yield and drying quality of the oil, are affected to a marked degree by environmental conditions, especially by temporature



inmain, covering a variation of this contains the distance of the first of the distance of the first plant and a contains and colling the colling of the first plant and a contained to coll in the cost. Among other findings, the correlations tells percentages of the different fatty saids in the cile and July temperatures during the cil-formation period are negatively correlated with linolenic acid and positively correlated with calmated and cloic acids, though the coefficients were small."

Nesbitt, L. L., Pinckney, A. J., Stoa, T. E., and Taimier, E. P.
1943. Oil Fermation in Flanseed. N. Dak. Agr. Expt. Sta. Toth. Bul. 125.
19 pp. April.

Presents data relating to changes in oil constituents of seed from flar plants harvested at regular intervals after full bloom.

Painter, E. P., and Nesbitt, L. L.

19h3. Stability of Linseed Oil During Storage of Flausced. N. Dak. Agr.
Expt. Sta. Bi-monthly Bul. 5(0): 30-h0, July.

"It is known that flax respires at a rapid rate. Idllevik and Geddes found high carbon dioxide concentrations in flan storage bins. Deaths of workers, probably due to the replacement of oxygen by earbon dioxide in the atmosphere of the storage kins, have occurred. The possibility that fatty acids might be utilized in respiration occurs; also owing to its chemical instability it seems likely that linseed oil would undergo chemical reactions when flarseed is stored. In these samples where the iedine number decreased most the percentage of cracked seeds and injured seed coats was much higher than in those samples which showed no apparent change in fedine number. Although our storage conditions were not strictly comparable to farm bins or elevators, it seems reasonable to assume that changes in the oil are insigmificant when flaxseed is stored. Average loss in icdine maker: 17 lots from Horthern Plains States and Canadian Locations, ranging from 17h to 192 icdine number in 1936 (first determination), look 1.8 points to 1943 (second determination); 38 love from Northern Plains and Pacific States and Canada, renging from about 169 to 200 iodine number in 1936, lost 0,8 points to 1941; 4 lots from Brockings, South Dakota, ranging from 174 to 177 isdine number in 1938, lost b points to 1961; 6 lots from Edmonton, Alberta, ranging from 191 to 197 icdine number in 1939, lost 0.1 points to 1911.

U. S. Dept. Agr.

1954. Sound Grain Fat Acidity Survey-1953 Crop. Agr. Mitg. Serv., 20 pp.

April. (Processed.)

Those of the 1952 and 1953 crop flarseed susples had fat acidity values of less than 10. As in the previous report the 3 1952-crop camples with fat acidity values of more than 60 were found to have very low governation values and could therefore not be considered.



fully sound. The limiting fat acidity value of ho a seed should be considered quite tentative in view of the unantentation that he percent of the unantentation that he percent of the unantentation can exceeded this value."

Tabular summary:

Itan	1951	1952	1423	3 etg-s
Number of samples	2h	25	39	88
Number of points of :	8.	5	31	©
Fat acidity: Average	64.2 268.7 24.0	55.8 320.4 10.7	21.1 b2.b 7.4	2201 2201 7.4
Percentage of samples : considered sound: (fat acidity below : l(0) :	h2	80	97	77

Stocks

Allen, S. G.
1954. Inventory Fluctuations in Flavored and Linseed Oil, 1926-39.
Econometrica 22(3): 310-328. July.

"The behavior of economic units engaged in the production and distribution of flaxseed and linseed oil in the United Stater is summerized in a system of linear stochastic equations. The latter contains such jointly dependent, doservable economic variables as production, stocks, and consumption of the above cosmodities. The particular equation system studied reflects the investigator's desire to explain quarterly inventory fluctuations in these some modities and is formulated in the light of market conditions prevailing during the period 1926-1939. Evaluating the estimates by their performance in a post-sample period was approached . . . but structural equations specified do not admit the wider range of economic experience of World War II and postwor periods . . . the technology of production as well as the influences underlying consumption of linesed oil changed and the conditions of world flauseed supply changed. Principly for the latter reason no claim of predictive usefulness water present conditions is ande for the estimates of these equations,"

Wromer, George W., and Gilliland, C. B.
1954. Processing the Three Major Cilseeds. U. S. Dept. Agr., Agr., Nitg.
Serv., Marketing Research Report No. 58, 38 pp. April.

"Receipts of flamseed at the oil mills for the 5 crops 1947 through 1951 ranged from 66 to 107 percent of flamseed produced,



averaging 83 percent. In the 1950-51.

Description of the state of the production of the state of the second of th

"Flanseed stored at oil mills represented only a small part of the total stored in the 1951-52 season. The bulk was stored on forms and at country elevators. Stocks at oil mills ranged from I to 3 times the average crush. Peak storage in December 1951 should? million bushels on hand. The relatively good storability of flanseed, except in Texas where the production is small, contributes to uniform operation of the processing plants."

Supply

1930. Farmers Response to Price in the Production of Flam. U. S. Dept.

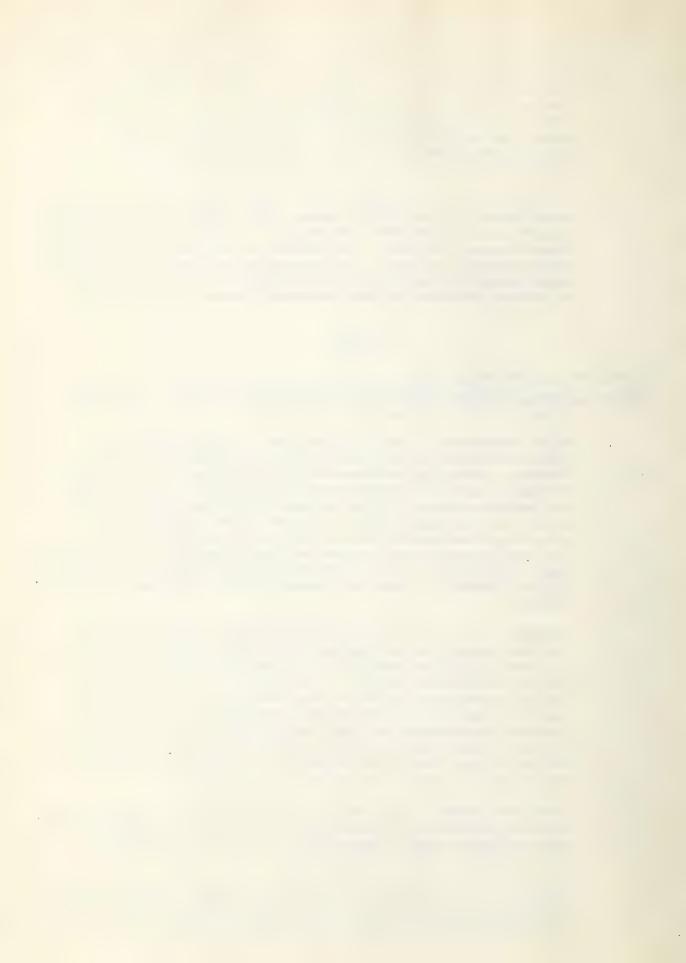
Agr., Bur. Agr. Econ., 33pp. (Processed.)

"Flax production in the U. S. confined largely to the k hard spring wheat States, Hinnesota, North and South Paketa, and Montana. During 1910-1929 variability in acreage averaged 11.5 percent. Changes in acreage were affected by relative yields and relative prices of flax and wheat with the amount departing in part on the position flax occupies in the rotation and in part the price sensitiveness of the producers. The larger the proportion of total returns obtained from the crop, the more rapid the change. Relative-acre-returns ratio measures effect both of physical factors and (through price) of economic comintions.

"Changes in U. S. flax acreege 1910-29 most closely related to combined ratio of acre value of flax to acre value of wheat (1) taken at time of seeding and (2) averaged with that taken during the marketing period. A flar-wheat ratio of 108 to 100 indicates no-change point for flax acreage. In 18 of the 20 years studied the movement of the acre-return ratio correctly forecast the direction of flax acreage change in the following planting season; and in only 2 years did the anount of change differ by more than 8 percent from the estimate, which accorded for about 95 percent of variation in flax acreage.

"The same general relationships were found for individual States, with the amount of unexplained variation higher and the no-change ratio higher in the 2 States nearer the Minneapolis and Signs City marketing centers, lower in the 2 States further away.

"Since relative profitability of flax with alternatives in a proceeding year is no criterion of profitability in the current year and since price relationships existing at seeding time may have



prevail at hervest time-farmers should alternatives on the basis of prospective point could be of prospective to the prospection of the prospectio

Hansen, Poter L., and Mighell, Romald L.
1917. Oil Crops in American Farming. U. S. Popt. Agr., Took, Pul. Po.
710, 55 pp. November.

cover the years flazzeed production in the U.S. has chifted geographically, but the principal flanseed-growing States occutions to be Minnesota and North Dakota, with South Dakota next in inportance. Although flazzeed still remains a relatively minor crop, in areas where alternative choice of crops is limited, flazzeed will probably be grown even at relatively low prices. Estimates made for each of the flazzeed growing States of probable future acreage, yield and production of flazzeed for each of 3 price situations expressed as ratios of flazzeed to wheat prices of 2.5, 2.0, and 1.5, show that such relative price changes would probably produce rather wide differences in production.

Hopper, T. H., and Johnson, Muriel
1941. Flax Production and Climate of North Dakota, 1919-1937. N. Dak. Agr.,
Expt. Sta. Bul. 290, 71 pp.

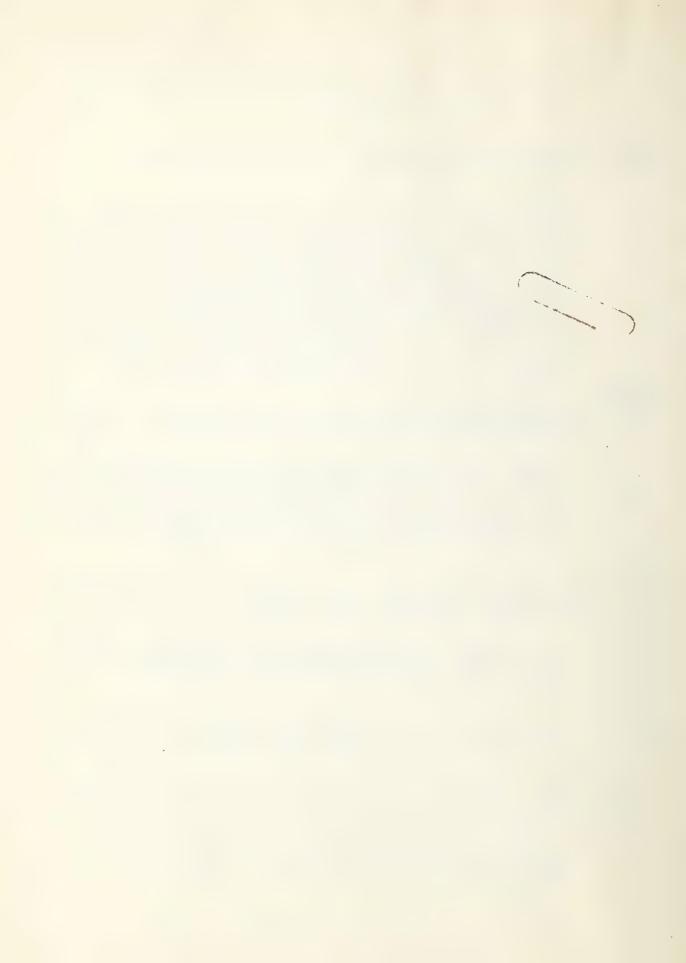
Presents data by crop reporting districts on acreage, yield and production of flanseed in North Dakota and Minnesota for 1919-1937, with full weather data for corresponding years. For period 1930-19 data showing range of oil content and icidne number, with corrolations developed between seasonal weather factors and yield and icidne number of linseed oil.

1941. Flax Production and Climate of North Dakote and Himmonote, 1919-1937, N. Dak, Agr. Expt. Sta. B. 298. 72 pp.

"The oil content of commercial flanseed is negatively correlated with temperature, but significantly related to variety and the loss of lighter weight, low oil content seed in the threshing and cleaning operations.

The iodine number, or relative drying quality, of linseed oil is positively correlated with yield and precipitation, and negatively and highly significantly correlated with July temperatures.

For the 19-year period the average annual abandoment of ell spring wheat acreage seeded was 12.5 percent ampured with 15.4 percent for all flax in the U. S. Abandoment has been large for both crops for the 1931-37 period because of deficiencies in moisture and excessive temperature. These conditions were more severe in North Dakota than in Minnesota, where abandoment of seeded acreage has been small."



Peterson, Weber H.

19h7. Flagged in American Farman, C. S. Dayle Act. Mills Elas II.

"The purpose of this study is to examine the supply position of flaxseed in the U. S. about 1955, after demand has settled down to a stable peacetime situation; to determine the competitive position of flaxseed as compared with alternative crops in the major flaxseed areas; and to estimate the probable acreage and production pattern... The procedure . . , to consider several alternative demand and price situations, and to estimate the probable production of flaxseed under each . . provides more information within a probable range of demand conditions. . . After the supply position for flaxseed was explored for each of the alternatives, the domestic demand and foreign trade situations for flaxseed were analysed and a tentative balancing of positions that might prevail under favorable economic conditions (was made.)"

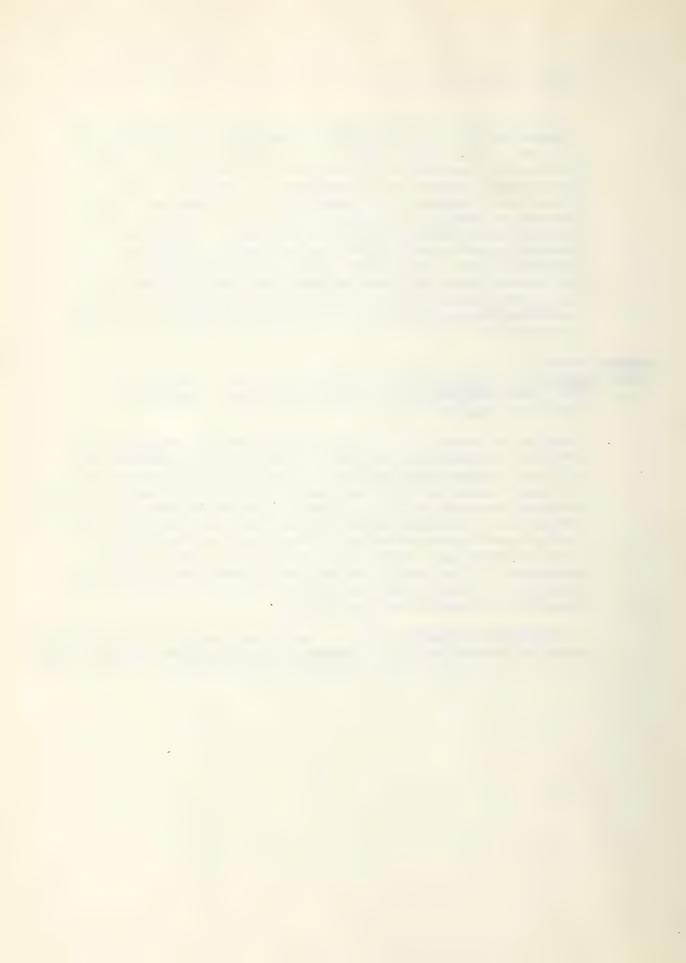
Thompson, Ned O.

1946. Economics of Flax Production in Eansas. U. S. Dept. Agr., Dur. Agr. Econ. and Kans. Agr. Expt. Sta., 2h pp. (Processed.)

Datelined Lincoln, Nebr.*

"Purpose to determine probable future of screage and production of flax in Kansas under different price, supply, and demand conditions, to determine how flax fits in the farming systems in the area, trends in yields and returns from flax as compared with alternative crops, and the influence of other factors on flam production. Increased emphasis on livestock and especially dairy cattle in Southeast Kansas would mean less land available for flax and other cash crops; trend toward larger farms aided in expansion of flam acreage (proportion of farms growing flam increases with size of farm and with mechanization as measured by comership of tractors and combines)."

^{*} Apparently prepared while the author was assigned as cooperative agent at lansas Agr. Expt. Station, Namhattan, Kansas, and published after he was transferred to Nebraska Agr. Expt. Sta., Lincoln, Nebr.



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General

Borna, Autoine
195h. Cilscens, Fats and Cils, and Elener Products, IN2-53. T. S.
Dept. Agr. Stat. Bul. No. 147.

Contains tables for flaxseed showing acreage planted and harvooted, supply, disposition and price per bushel to farmers commensing 1912; outturn, wholesale price and value of oil and most per bushel crushed commencing 1926; season average price received by growers commencing 1909. For linseed oil, supply and disposition annually commencing 1916; details of supply, disposition and utilization commencing 1912; monthly wholesale prices commencing 1926. For linseed meal, monthly wholesale prices commencing 1926, apply, disposition and utilization commencing 1918.

U. S. Dept. Agr. 1953. Agricultural Statistics (Annual)

Contains tables for flarseed showing production and ferm disposition, by States, current and provicus years; inspected receipts by grade, by crop year commencing 1913; supply and distribution amountly, 10 most recent crop years; quarterly stocks on farms and off farms, commencing 1917; crushings, oil and meel outturn, foreign trade and prices of linseed oil and linseed meal, amountly, commencing 1913 crop year.

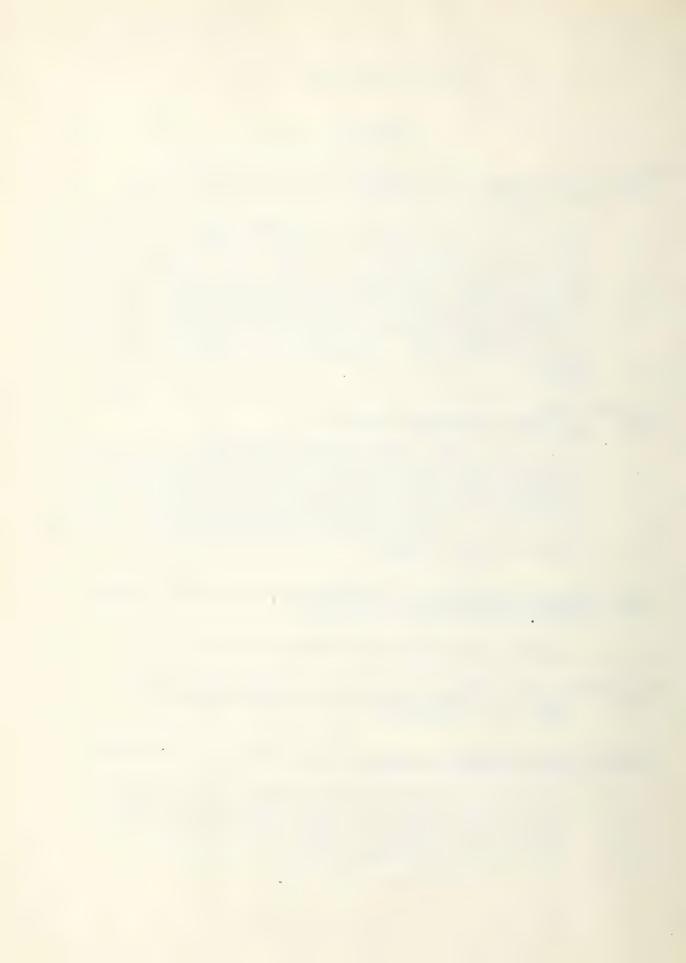
1954. Fats and Oils Situation. Washington, D. C. and earlier issues. Fublished biscothly. (Processed.)

Centains current information similar to the above sources,

U. S. Bureau of the Census 1919-5h. Facts for Industry, Animal and Vegetable Pats and Cils. Series M-17. (Annual.)

1919-54. Facts for Industry, Fats and Oils. Series M-17. (Monthly.)

Contain data on receipts, crushings, and stocks of oil-bearing materials at oil mills; production shipments and stocks of primary products except crude oil at oil mill locations; production, consumption and factory and werehouse stocks of primary materials and of secondary products.



U. S. Bureau of the Census 1931-5h, Facts for Industry, Fats and Oils, Consumption by Uses. Series M-17. (Monthly.)

Inspection

U. S. Dept. Agr., Prod. and Marketing Admin. and Ext. Service 1943-1953. Annual Sugmary of Inspections and Grading of Carlot Recoimic of Flaxseed.

Prices

U. S. Dept. Agr., Agr. Marketing Service 1954. Grain Market News and Statistical Report (Weekly)

Flanseed prices, cash Minneapolis, and U. S. average farm prices.

1954. Agricultural Prices. (Monthly) and earlier years.

Average farm prices, by States.

U. S. Dept. Agr., Commodity Exchange Authority 1954. Trade in Grain Futures (Monthly) and earlier years.

Contains data on trading and prices for futures contracts of various materities currently being traded.

Steeks

U. S. Bureau of Agr. Economics
1952. Farm Stocks of Crains, Cilcreds and Hay, 1944-51. Revised estimates, by States. (Quarterly.)

1951-1954. Flanseed and Soybean Stocks. (Quarterly.)

Contains current data on off-farm stocks, by market level and by States, in January, April, July, and October issues. Commencing 1954, issued by Agr. Marketing Service.

1952. Crop Production. (Monthly.)

Contains current data on flarseed and grain stocks on farms, quarterly, in January, April, July, and Ostober Leanes. Torus commencing 1954 by Agr. Marketing Service.

1951. Stocks of Grains and Ollsoeds in Off-farm Positions, by States, quarterly, 1944-51.

Contains flaxseed series commencing 1947.



U. S. Dept. Agr., Agr. Mktg. Service. 195b. Grain Harket News and Statistical Report. (Weekly.)

Contains current supply and distribution data, quarterly. For earlier years, quarterly Flauseed Market Survey, U. S. Dept. Agr., Prod. and Marketing Adm., and Quarterly Flauseed Marketing U. S. Dept. Agr., War Food Administration.

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 No. 692, 78 pp.
- (3) Hall, Thomas E., Hemphill, P. V., Meyer, C. H., and Davis, W. K. 1951. Where and How Much Cash Grain Storage for North Dakota Farmers. U. S. Dept. Agr., Farm Credit Adm. Bul. No. 61, 52 pp.
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